

**Heathkit of the Month #101:
by Bob Eckweiler, AF6C**



AMATEUR RADIO - SWL

**Heathkit HD-1426
Relative (RF) Field-Strength Meter**

Introduction:

A field-strength meter (FSM) is one of those ham accessories that might seem unnecessary, especially in an urban environment. If you mess with mobile antennas or have the open space to put up an antenna range, the FSM becomes a tool of necessity. I wonder how many hams have one sitting in their shack and enjoy watching the field strength meter swing as they transmit? There is a real 'cool-factor' to that for shack guests.

Over the years Heathkit produced three field strength meters: the **PM-1 "RF Power Meter"** (1957-1959), the **PM-2 "Mobile Tuning Meter"** (1959-1975) and the **HD-1426 "Relative Field Strength Meter"** (1977-1981 - **Figure 1**). All these meters are self-powered and do the same thing, though their names vary. They are uncalibrated, but can be used for relative field-strength measurements. A variable resistor, the only control, adjusts the sensitivity and is used to keep the signal on scale in strong fields. Each device has a binding post for connecting an antenna. A length of wire taped to the wall works well. These meters have a maximum full-scale sensitivity of

Here is a link to the index of Heathkit of the Month (HotM) articles:

http://www.w6ze.org/Heathkit/Heathkit_Index.html



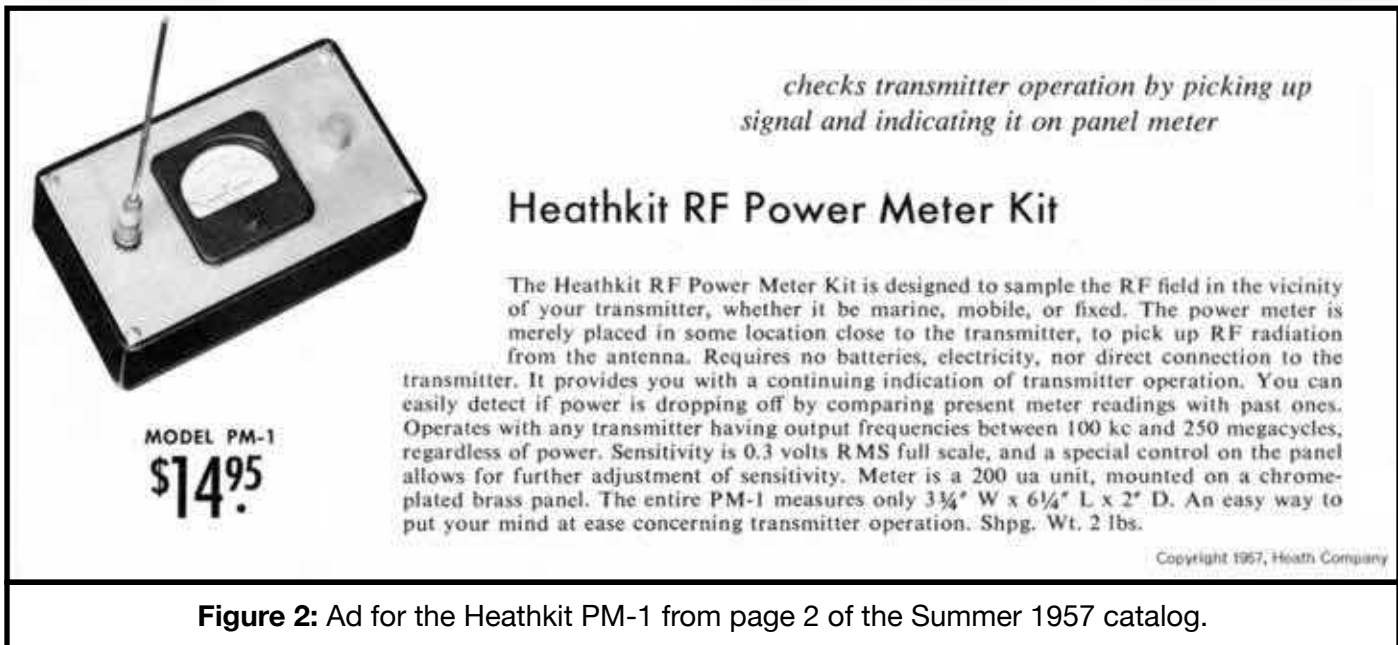
Figure 1: Heathkit HD-1426

about 0.3 RF volts rms at the antenna terminal.

PM-1 "RF Power Meter":

The PM-1 (**Figure 2**) is believed to have been introduced in the winter 1957 catalog¹. In the later summer catalog it is shown in a two page spread of newer kits (pages 2 and 3) along with two new kits, the FD-1-6 (-12)² Fuel Vapor Detector for motorboat enthusiasts and the XR-1 Transistorized Portable Radio. A schematic of the PM-1 has not been found, but it is assumed to be identical or very similar to the later PM-2; these circuits are not complex. Originally, the PM-1 was listed among the boating accessories as a way to determine that your marine radio was transmitting.

The PM-1 is built into a 3¼" x 6¼" x 2" bakelite box with a chrome-metal faceplate. The plate contains a binding post for the antenna, a sensitivity control and a 2½" square meter. The 200 µA meter was made by Simpson. The meter scale goes from 0 to 10 in 51 divisions, eleven of them major. Near the end of production, the meter was replaced by an all-plastic faced meter in the style of the later AM-2 and DX-40.



checks transmitter operation by picking up signal and indicating it on panel meter

Heathkit RF Power Meter Kit

The Heathkit RF Power Meter Kit is designed to sample the RF field in the vicinity of your transmitter, whether it be marine, mobile, or fixed. The power meter is merely placed in some location close to the transmitter, to pick up RF radiation from the antenna. Requires no batteries, electricity, nor direct connection to the transmitter. It provides you with a continuing indication of transmitter operation. You can easily detect if power is dropping off by comparing present meter readings with past ones. Operates with any transmitter having output frequencies between 100 kc and 250 megacycles, regardless of power. Sensitivity is 0.3 volts RMS full scale, and a special control on the panel allows for further adjustment of sensitivity. Meter is a 200 ua unit, mounted on a chrome-plated brass panel. The entire PM-1 measures only 3 3/4" W x 6 1/4" L x 2" D. An easy way to put your mind at ease concerning transmitter operation. Shpg. Wt. 2 lbs.

MODEL PM-1
\$14.95

Copyright 1957, Heath Company

Figure 2: Ad for the Heathkit PM-1 from page 2 of the Summer 1957 catalog.

PM-2 "Mobile Tuning Meter":

In 1959 the PM-2 replaced the PM-1. This FSM was designed with the mobile radio crowd in mind. Where "RF POWER METER" is printed across the PM-1 meter face, the PM-2 says "MOBILE TUNING METER". The only feature, other than size, that relates to "mobile" is a magnetic base on the chassis that allows it to be mounted on a car fender or metal car dashboard while tuning. The PM-2 has the same antenna binding post and sensitivity control as the PM-1. The meter is the newer style plastic face, and could be the same meter as used on the late PM-1 with an updated meter face?

The PM-2 styling is completely different than the PM-1. It uses the same style sloping chassis as the HD-20 Crystal Calibrator (HOTM #99) with an auto-aligning magnet added to the base. **Figure 3** shows the PM-2 with a chrome knob that was furnished with the early units. The PM-2 later came with a gray plastic knob, similar to the one used on the PM-1. The PM-2 was in production for over 15 years. In 1959 it originally sold for \$12.95; and was still \$12.95 in the March

1974 catalog. Did the savings between a metal and plastic knob really keep the price stable over 15 years?

Figure 4 shows an early ad for the PM-2 from May of 1961. It was no longer featured with the boating accessories, but had moved to the ham radio accessory section.

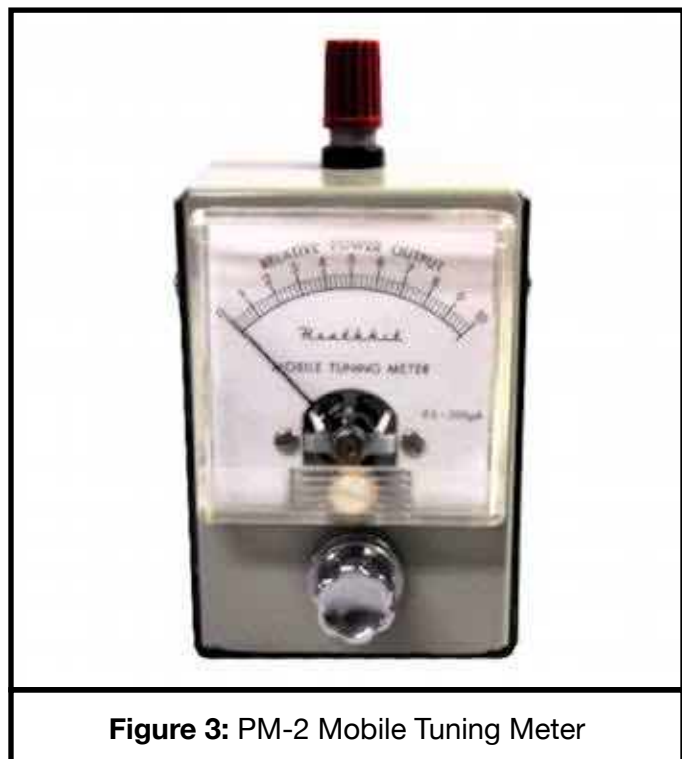




Figure 4: May 1961 Catalog ad for the PM-2

Since the sensitivity control acts as a rheostat, the meter will respond when the sensitivity control is at its minimum position. Again, assuming the internal meter resistance is 1100 Ω, the PM-2 will respond f.s. to an RF field of a bit over 20 V. That's a reasonably strong field and reducing the length of the antenna is a simple way to decrease sensitivity.

HD-1426 "Field Strength Meter":

In 1977, about a year after the PM-2 disappeared from the Heathkit catalog and stock ran out, the HD-1426 "Field Strength Meter" appeared. When introduced, the selling price was \$12.95, the same as the PM-2. The HD-1426 continued to be sold

Figure 5 is the schematic of the PM-2. RF enters via the antenna connector on the left and is rectified by the diode. The 100 KΩ sensitivity pot, wired as a rheostat, controls the meter deflection depending on how strong the local RF field is. The .01 μf capacitor filters the rectified RF. The ever-so-important 1.1 mH RF choke (not a critical value) provides a DC return path for the current going through the meter. Without it the meter won't respond.

into 1981. In the 1978 catalog the price dropped to \$10.95; one has to assume that the savings came from the inexpensive meter. It appears to be the same style meter used on the HD-1250 Dip Meter^{3,4} which uses glue as balance weights, and on some the glue is hygroscopic and tends to swell over time, making the meter go out of balance or stick.

A typical 200 μA meter has an internal resistance of 1100 Ω, corresponding to 0.22 VDC full scale with the sensitivity pot at its lowest resistance setting. Even with circuit losses and the benefit of the conversion from volts rms to VDC the PM-2 should easily meet the 0.3 V RF sensitivity specification.

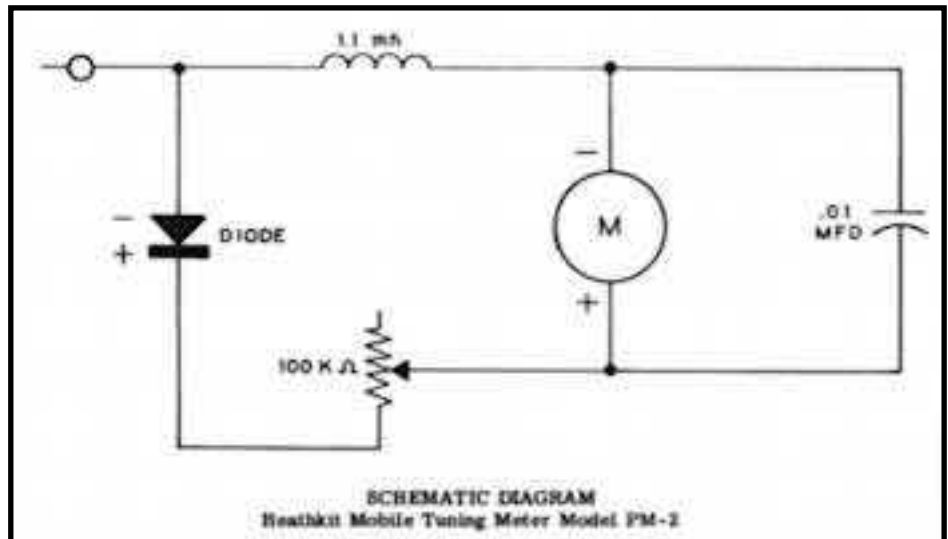


Figure 5: PM-2 Schematic. M is 200 μA f.s. The diode is germanium, a Hughes HD-2257 - identified by red - green - violet bands (257).

The HD-1426 measures 4¼” x 4¼” x 2½”. The small composite cabinet tapers down slightly in height towards the rear. A similar cabinet is used in the HD-1416 Code Practice Oscillator, and over the years it came in light green-gray, brown and black. While the cabinet for the HD-1426 is believed to have only come in green-gray, the HD-1416 CPO came in brown (as the HD-1416A) and black (as the HD-1416H). A black version of the cabinet, the SK-99 ⁵, was sold as an accessory for the SK-104 1-watt Audio Amplifier and SK-107 Stereo Synthesizer (HOtM # 69) kits.

While the PM-1 and PM-2 use point-to-point wiring, the HD-1426 uses a printed circuit board to mount the choke and diode. Part of the circuit board is a 72” (approx.) etched-foil antenna. This antenna picks up nearby RF fields because the cabinet is composite and doesn’t shield the internal antenna. The choke used is the same part as in the PM-2, but the

diode changed to a more readily available (at the time) 1N295. The meter sensitivity has been increased to 150 µA

The HD-1426 has the same features as the PM-1 and PM-2. It has a sensitivity control and a binding post for an external antenna. A 12” length of bare wire is supplied as a simple external antenna. The manual instructs that a small loop be formed on one end of the antenna wire to provide some protection from getting poked by the sharp wire end.

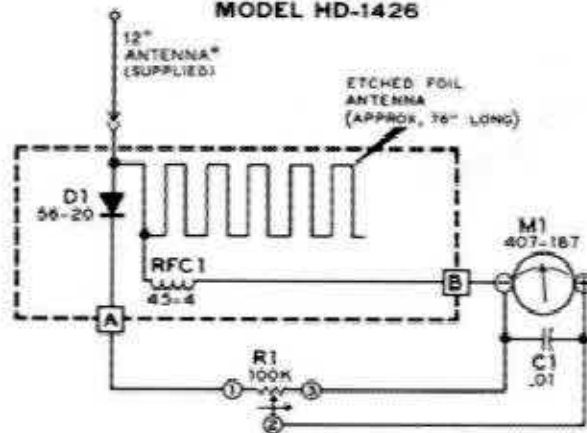
Figure 6 is the schematic of the HD-1426. The sensitivity control is now wired as a potentiometer allowing control of the sensitivity all the way down to zero.

The PM-1 and PM-2 are both specified to operate over the range of 100 kilocycles to 250 megacycles and have a maximum sensitivity of 0.3 VRMS at the antenna terminal. The



SCHMATIC OF THE HEATHKIT® RELATIVE FIELD STRENGTH METER MODEL HD-1426

D1	1N295
M1	150µA
RFC1	1.1mH



*NOTE: YOU may use any desirable added wire for increased instrument sensitivity.

Figure 6: Schematic for the HD-1426 Relative Field Strength Meter.

HOM rev. new

HD-1426 is rated at 1.8 MHz to 250 MHz., and while the meter sensitivity has increased, the specifications no longer give a full scale sensitivity figure. The change in the low-end frequency range probably is more a result of adjusting the specifications to the amateur bands than a drop in performance.

All three of these kits are easily assembled in one evening.

FSM as a Club Project?

The field strength meter might make an interesting club project? Parts should be readily available, and they can be built into a simple plastic case. The cost will depend on whether a source for an inexpensive 0-200 μ A meter can be found. MPJA had one in their catalog for under \$15 but I don't currently see it on their website. Any thoughts?

What's Been Happening:

With the pandemic still raging in the US I've had some time to work on updating some of the HOTM articles. This is a lot of work as Apple© may want you to "Think Different", but once you've written a document they make it hard for you to keep it updated. Many of the articles from older AppleWorks and the earlier Pages word processing programs don't convert easily to the later versions. Graphics are one of the most recent problems. If the original graphic was "dropped in" it appears in the new article as a box with a big X in it. Recreating those graphics is very time consuming.

The current Heathkit project here is the restoration of an old QM-1 Q-Meter. A check of the unit found a few resistors out of tolerance and of course the two 8 μ F 475V electrolytic capacitors in the power supply need to be replaced. This QM-1 has been in storage for awhile (it was last used to measure the loading coils Ken - W6HHC built for his

Heath of the Month #101 - Model Description

30-meter antenna)⁶. The most noticeable problem during initial restoration was that the built-in vernier drives on the two main variable capacitors were frozen. That problem is now solved and they turn smoothly. This will be covered in an upcoming article.

I thought I had written an HOTM article on the QM-1, but evidently I didn't. So, look for one in the near future.

Thanks to Santos e Silva, the parts list for the O-1 and O-2 oscilloscopes have been added to the ['O'-Series support page](#).

73, from AF6C



Notes:

1. Thanks go to Chuck Penson - WA7ZZE for helping firm up the introduction date of the PM-1
2. The FD-1 Fuel Vapor Detector kit came in two versions for boats with 6 or 12 volt electrical systems (FD-1-6 or FD-1-12).
3. The HD-1250 Solid-State Dip Meter is covered in [HOTM #7](#).
4. Repairing the meter movement in the HD-1250 Solid State Dip Meter is discussed in [HOTM #66](#).
5. For more information on the SK-99 optional cabinet see page 3 of [HOTM #69](#).
6. *A Shortened 30M Dipole Antenna* by W6HHC in 3 parts: [RF Newsletter](#) Mar., Nov. & Dec., 2005.

This article originally appeared in the August 2020 issue of RF, the newsletter of the Orange County Amateur Radio Club - W6ZE.

Remember, if you are getting rid of any old Heathkit Manuals or Catalogs, please pass them along to me for my research.

Thanks - AF6C